

Written Reply

To Mr. Junya GOTO, Examiner at the Patent Office

1. Identification of the International Application

PCT/JP2004/004045

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5. Contents of this Argument

(1) The Examiner considers that claims 1 to 8 of the present application lack an inventive step.

In view of the Examiner's consideration, the Applicant filed a Written Amendment to amend the claims in the present application on the same date of this Written Reply. We believe that this amendment will lead to an acknowledgment that the present invention has an inventive step.

(2) Contents of the amendment in the Written Amendment are mainly as follows.

(i) Claim 1 is amended so as to clarify that at least a part of the cable substrate is covered with the sensor ground substrate or the relay ground substrate.

This amendment is based on original claim 3.

(ii) Claim 8 is added. This amendment is based on the description on page 17, line 23 to page 18, line 3 (page 18, line 30 to page 19, line 8 of the English translation) of the present specification.

(3) Inventive step of the present invention

(i) Description of the present invention

As described in the Written Amendment, the invention according to claim 1 of the present application relates to
 “an ultrasonic probe, comprising: an ultrasonic element for transmitting and receiving an ultrasonic signal; a signal line for transmitting an electric signal to or from the ultrasonic element; and a ground line for supplying a ground potential to the ultrasonic element, the ultrasonic probe further comprising:

a sensor signal substrate and a sensor ground substrate connected electrically with the ultrasonic element; and

a cable substrate for electrically connecting the sensor signal substrate and the sensor ground substrate with the signal line and the ground line, respectively,

wherein the sensor ground substrate and the cable substrate are connected directly or via a relay ground substrate, and

at least a part of the cable substrate is covered with the sensor ground substrate or the relay ground substrate.”

According to the present invention, the sensor ground substrate and

the cable substrate are connected directly or via the relay ground substrate. Therefore, unlike the case where these substrates are connected via a connector, it is possible to avoid an increase in resistance due to limitations on the number of connector poles, resulting in a reduction in ground resistance between the sensor ground substrate and the cable substrate. Consequently, the reduction in ground resistance suppresses a change in ground potential due to a noise current induced by extraneous electromagnetic waves. As a result, an adverse effect on a reception signal due to the change in ground potential is reduced, and image noise can be prevented from being caused.

Further, since at least a part of the cable substrate is covered with the sensor ground substrate or the relay ground substrate, the sensor ground substrate or the relay ground substrate can function as a shield for shielding at least a part of the cable substrate. Therefore, it is possible to suppress noise from being caused due to extraneous electromagnetic waves, and the ultrasonic probe exhibits increased durability to withstand electromagnetic waves.

(ii) Description of cited documents

Document 1 (microfilm on which contents of the specification and the drawings attached to the application of Japanese Utility Model Application No. 63-69188 are recorded) discloses an ultrasonic probe including a ground electrode and a signal electrode, wherein the ground electrode is connected with a ground wire via a third electrode (Figure 2 etc.). However, Document 1 does not describe that the respective electrodes are connected by using a substrate. In addition, there is neither description nor suggestion about the configuration in which at least a part of the cable substrate (corresponding to the above-mentioned third electrode) is covered with the sensor ground substrate (corresponding to the above-mentioned ground electrode) or the relay ground substrate.

Document 2 (JP 2001-54194 A) discloses an ultrasonic probe in which an oscillator and cables (the signal line and the ground line) are connected by using a substrate (Figure 2 etc.). However, Document 2 does not refer to a specific configuration of the substrate. In other words, it is not described that the oscillator is connected with the sensor signal substrate and the sensor ground substrate, and these substrates are connected with the signal line and the ground line, respectively, via the cable substrate. In addition, there is neither description nor suggestion about the configuration in which at least a part of the cable substrate is covered with the sensor ground substrate or the relay ground substrate.

Document 3 (JP 11-347032 A) discloses an ultrasonic probe, but does not refer to the configuration in which an oscillator is connected with the signal line and the ground line.

(iii) Comparison between the present invention and the inventions of the cited documents

As described above, Documents 1 to 3 neither describe nor suggest the configuration of the present invention in which at least a part of the cable substrate is covered with the sensor ground substrate or the relay ground substrate. Therefore, the present invention provides a particular configuration that is obviously different from that described in each of the above documents.

With this particular configuration, the sensor ground substrate or the relay ground substrate can function as a shield for shielding at least a part of the cable substrate. Therefore, it is possible to suppress noise from being caused due to extraneous electromagnetic waves, and the ultrasonic probe exhibits increased durability to withstand electromagnetic waves. In this manner, the present invention can achieve a special effect, which cannot be achieved by the invention described in each of the above documents.

Therefore, we believe that the present invention is not obvious from the above documents and involves in an inventive step.

(4) The inventions according to claims 2 and 4 to 9 restrict the invention according to claim 1 further. Since the invention according to claim 1 has an inventive step over the above documents as described above, claims 2 and 4 to 9 would also have an inventive step.

(5) As described above, we believe that the present invention has an inventive step. We respectfully hope for the Examiner to consider that the present invention involves in an inventive step after due reexamination of the present application.

6. List of appended documents

(1) Written Amendment

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